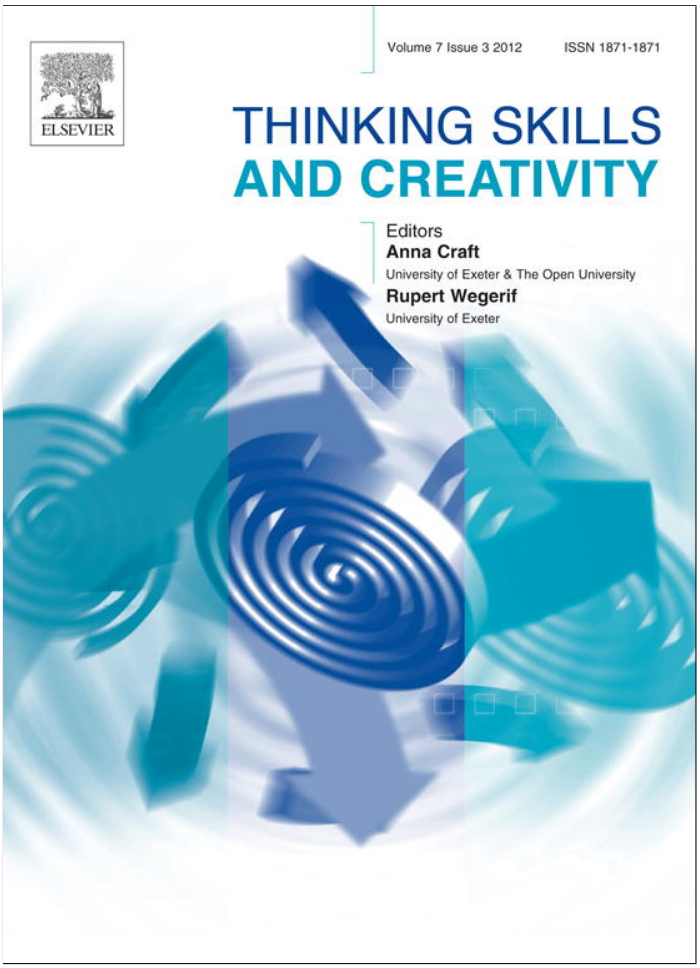

Thinking Skills and Creativity 7 (2012) 258–264

Contents lists available at SciVerse ScienceDirect

Thinking Skills and Creativity

journal homepage: http://www.elsevier.com/locate/tsc

Keynote

Can creativity be measured? An attempt to clarify the notion of creativity and general directions for future research

Davide Piffer*

Università degli Studi di Firenze, Dipartimento di Biologia Evoluzionistica, Laboratori di Antropologia, Via del Proconsolo, 12, Firenze, Italy

ARTICLE INFO

Article history:
Received 19 December 2011
Received in revised form 31 March 2012
Accepted 25 April 2012
Available online 4 May 2012

Keywords:
Creativity
Divergent thinking
Creativity tests

ABSTRACT

The goal of this investigation is to demonstrate that much of the confusion regarding the measurement of creativity is caused by the insufficient clarity of its definition and to provide suggestions for an improved assessment and new possible tools of investigation (e.g. interviews).

It is shown that three dimensions of creativity (novelty, appropriateness and impact) constitute a framework within which creativity can be defined and measured.

Further clarity to the definition of creativity is added by distinguishing between person's and product's creativity and providing definitions for each.

Based on this new definition, it is argued that Divergent Thinking, Remote Associates or some personality scales can be considered neither the only components of the creative process/cognition/potential nor "creativity tests". The use of the terms "creativity test" and "measure of creative process" in the literature are criticized and it is indicated when they should be used.

It is also shown that claims to have found a general factor of creativity are based on methodological and conceptual errors.

Finally it is concluded that a person's creativity can only be assessed indirectly (for example with self report questionnaires or official external recognition) but it cannot be measured directly.

1. Introduction

Mayer's (1999) review of seven definitions given by authors contributing to the 1999 'Handbook of Creativity' (Sternberg, 1999), provided the following definition of creativity: "[. . .]creation of new and useful products including ideas as well as concrete objects." A more recent, albeit unsystematic, review has confirmed the importance of this definition (Andreasen, 2005).

A product which is useful but not novel (a car might be judged novel in an ancient civilization but not in the contemporary one), or novel but not useful (e.g. bizarre or schizophrenic ideas) cannot be considered creative. However, judgments of novelty or usefulness are inevitably subjective and depend on the culture and the historical period. The criteria of usefulness become inadequate in the context of artistic creativity. Thus, the definition has sometimes been expanded to include the concept of beauty (Arden, Chavez, Grazioplene, & Jung, 2010). Another concept, named appropriateness, has been introduced to account for products that are creative but not useful in a strict sense. This concept is part of a prominent definition of creativity (Zeng, Proctor, & Salvendy, 2011). The notion of appropriateness "evokes people's intention to purchase, adopt,

* Corresponding author. Tel.: +39 347 0916177.
E-mail address: davidepiffer@libero.it

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http://dx.doi.org/10.1016/j.tsc.2012.04.009

use, and appreciate" a (creative) product. Therefore, appropriateness incorporates the concept of usefulness but goes beyond it, allowing one to regard as creative certain products (such as art) that are not useful in the strict sense.

Indeed, judgments about a product's creativity depend on the recognition by a community of experts (as in science, the visual arts or classical music) or by the general population (as in popular art, commercial products). Another aspect that emerges in discussions of creativity is that of impact or influence (e.g. Csikszentmihalyi, 1996; Simonton, 1994, 2004).

The notion of appropriateness is similar to but must not be confused with the notion of influence or impact of a product. Appropriateness is different from impact as the former indicates agreement among the public or the community of experts about a product's creativity, whereas the latter indicates the extent to which an idea changes a particular domain, as reflected in this definition of creativity: "Creativity is any act, idea, or product that changes an existing domain, or that transforms an existing domain into a new one" (Csikszentmihalyi, 1996). The traditional distinction between Big-c and little-c creativity highlights the importance of this concept. The first is synonymous with eminent creativity and is usually believed to be limited to well-known creators or renowned individuals. Little-c, or everyday creativity, consists of the creative activities in which people might participate each day and is found across all the demographic spectrum, from college students to children (Kaufman & Beghetto, 2009). Kaufman and Beghetto (2009) introduced the four C model of creativity, providing many concrete examples that certainly fit with our commonsensical grasp of the different levels of creativity. However in my opinion, this classification is not based on a solid theory but relies on anecdotal and intuitive examples (e.g. big-C creativity is not properly defined but is illustrated with examples of eminent classical and opera composers, Nobel prize winners and revolutionary scientists; similarly, the definition of pro-C is very pragmatic "anyone who attains professional level expertise in any creative area" (Kaufman & Beghetto, 2009). I would argue that the third dimension of creativity (impact) provides a more general yet parsimonious perspective to the classification into two or four types of creativity, which can be seen as lying on a continuum from null to great, lasting contribution/impact to a field.

For example, in Kaufman and Beghetto's Four C model (2009) mini-c creativity could be seen as comprising all creative activities which are novel and useful, whilst having little of or lacking the third factor, that is the property of leaving a mark on the field or changing the culture. Indeed, Kaufman and Beghetto (2009) conceptualize mini-c as the set of intrapersonal insights and interpretations, which often live only within the person that created them".

Thus both the review of definitions of creativity and the four C model acknowledge that novelty and usefulness are common to all creativity levels, whereas impact is not a necessary precondition (its absence is normal at the level of little or mini-c creativity) for creativity.

2. A new definition of creativity

What has been given so far is a definition of "creativity" but it is clear that it is more relevant to products than to people, even though it does not explicitly refer to either of the two. Sometimes (but rarely) the definition explicitly encapsulates both person and product. Thus, in Zeng et al. (2011) "creativity is broadly defined as the goal-oriented individual/team cognitive process that results in a product (idea, solution, service, etc.) that, being judged as novel and appropriate, evokes people's intention to purchase, adopt, use, and appreciate it." However, with such a broad definition, one is at a loss as to how creativity could be measured. Should we measure the creativity of the person or of the product? How do we measure them? Indeed, not enough effort has been spent on clarifying the important distinction between person's and product's creativity, as they are usually (either explicitly or implicitly) lumped together.

In fact, researchers are interested as much in creative products as in creative people. What is, then, a creative person? To the best of my knowledge, no clear and precise answer to this simple question has been provided in the literature.

I regard a person's creativity as the total sum of the creativity of the products that he/she has generated. Thus, I argue that the definition of creativity corresponds to that of creative achievement.

I assume that a product's creativity is a continuous rather than a categorical variable (a product is not simply either creative or not but it can be more or less creative than another product). Thus, a product's creativity depends on the degree to which it is useful/appropriate, influential and novel. Let a, b, c, . . ., i be the creative products. Let each creative product have a creativity score $0 < z <$ infinite. Let Za, Zb, Zc, . . ., Zi, be the creativity scores of the different products.

The sum of the creativity scores ($Za + Zb + Zc + \cdots + Zi$) of all the products generated by a person represents that person's creativity.

This notion needs to be separated from that of creative potential. I argue that the latter represents a broad set of variables that participate in generating a creative product. Creative cognition and creative personality are subsets of one's creative potential. The latter includes also biographical factors, genetic and epigenetic influences, psychopathological traits (Feist, 2010). Creative cognition can perhaps best be defined as the set of cognitive traits that concur in the process of generation of a creative product. Creative personality is a set of personality variables that are commonly found among creators and are thought to influence a person's creativity (Feist, 1998).

For the sake of clarity it must be briefly mentioned that another important field of creativity research is concerned with the creative process. This realm of inquiry generally belongs to cognitive psychology and is thus based on an experimental rather than a correlational approach. The majority of issues referred to in this paper fall within the realm of differential psychology. However, I believe that experimental research could benefit from considering the solutions proposed in the present article.

I admit that the definition of creativity proposed here breaks with the popular perception. In folk psychology, people with certain personality and cognitive traits (e.g. original, even bizarre thoughts and behavior, and a more active imagination) are generally considered as more creative than people who display less of these characteristics.

This is likely why tests of divergent thinking (DT) or the Creative Personality Scale (Gough, 1979) have occupied such a prominent position as to finally become synonymous with creativity. There are important reasons why scientific psychology cannot adopt intact the popular perception of creativity:

1. There are already simpler and more clearly defined concepts, such as "originality", "openness to experience", "divergent thinking", "schizotypal personality" that define each of these characteristics. It is preferable to use simpler concepts when they describe a phenomenon as well or better than more complex concepts.
2. These concepts describe clearly distinct constructs.
3. The use of each of these constructs as a criterion measure of creativity, such as happened with RAT (Domino, Walsh, Reznikoff, & Honeyman, 1976) and Divergent Thinking (Furnham & Nederstrom, 2010), has never proceeded from a robust theory or definition of creativity.
4. Empirical studies supported by theory have revealed that more conventional thought processes (e.g. convergent thinking) are required for creativity (e.g. the creation of novel and useful products) (Cropley, 2006).
5. Finally, a clear, rigorous definition of a concept is necessary for any theoretical and empirical advancement of a given field. Research that is based upon a fuzzy, intuitive perception of a phenomenon based on popular stereotypes cannot yield interpretable results. Instead, plenty of contradictions and problems emerge (e.g. controversy on the threshold theory; the difficulty of finding a general creativity factor similar to g for general intelligence and the disappointing results of neuroimaging studies).

3. Do creativity tests really exist?

In Section 1, I provided a general picture of the definition of creativity that emerges from a review of the relevant psychological literature. Given the prominent role played by DT tests in the assessment and discussion of creativity, it is necessary to determine whether they deserve the great status they received in light of the new proposed definition of creativity. Divergent thinking tests (e.g. Guilford's, 1967; Torrance, 1974; Wallach & Kogan, 1965) are different from traditional intelligence tests in that they demand not one right answer, but as many different responses as possible.

The responses are then scored on objective scales, usually fluency (number of responses), flexibility (number of different categories), originality (statistical frequency of the answers) and elaboration (amount of details given).

Often in published papers, DT tests are considered a measure of "creativity". Sometimes, they are more "carefully" called "tests of creative process" (Torrance, 1988). Yet, according to our definition of person's or product's creativity, DT tests cannot be considered measures of creativity, as they neither assess one's lifetime creative output (person's creativity) nor the creativity of a product (answers to DT tests are not creative products but rather ideas that, after selection and elaboration, could lead to creative products). At best, they can be considered a measure of creative potential, or cognition/process. But we will briefly see that even in this case, caution should be taken.

A few examples taken from the literature on creativity shall suffice to illustrate the misuse of the term. The name of the most popular "creativity test", the Torrance Test of Creative Thinking, is exemplar. Its name suggests that other cognitive tests (e.g. Working memory tests, general knowledge, IQ tests) are not tests of creative thinking. And this can be misleading because convergent thinking is as important for creativity as divergent thinking. Creative production is as much based on knowledge and analytical thinking as on imagination and divergent thinking (Cropley, 2006; Gabora & Kaufman, 2010).

Yet, unfortunately this confusion continues to plague even the most recent literature on creativity.

In Plucker and Makel (2010), the terms "creativity test", "tests of creativity", "psychometric measurement of creative process" are used 7 times. At least twice, these terms are implied to be equivalent to DT tests. For example: "Although psychometric test of creativity may lack evidence of predictive validity, researchers have suggested several possible reasons for DT tests' perceived weaknesses" (p. 54); "However, one important caveat is that it is not universally accepted that psychometric measures of creative process have poor predictive power. In fact, several studies provide at least limited evidence of discriminant and predictive validity for DT tests" (p. 54). "A final concern with the psychometric measurement of creative processes involves how these batteries are typically scored. There is some evidence that alternatives to the traditional frequency tabulations of fluency, flexibility, originality and elaboration should be considered" (p. 55).

I think that there is nothing wrong with regarding DT tests as measures of creative process. However, the same term should then be applied to all cognitive tests that can potentially lead to a creative solution. Since other cognitive variables (e.g. long term memory, working memory, etc.) take part in the creative process, then the tests that measure them should also be called tests of creative process.

The supposed equivalence between DT tests and creativity is most evident in the proposed Creativity Quotient by Snyder, Mitchell, Bossomaier, & Pallier (2004).

Other recent papers show the dramatic confusion creativity researchers are in. An example is the title of a widely cited paper, such as "Can We Trust Creativity Tests? A Review of the Torrance Tests of Creative Thinking (TTCT)" (Kim, 2006). Another paper by Kim shows the same confusion. In "Can only intelligent people be creative?" (Kim, 2005), she presents

a "quantitative review of the relationship between creativity test scores and IQ scores". In this study, creativity tests are Guilford's, the omnipresent TTCT, Wallach–Kogan. Again, creativity is equated with scores on DT tests.

In "Ability, demographic and personality predictors of creativity" (Furnham & Nederstrom, 2010), as suggested by the title creativity is assumed to be equal to DT. This is evident in Section 1, where it is reported that their study "sought to examine the ability, personality and demographic correlates of creativity as measured by the Consequences Test". It is even more remarkable that, according to the authors, this test is "extensively used in creativity research as a criterion measure of creativity" (Furnham & Nederstrom, 2010). In reality, DT is one of the predictors and not a criterion of creativity.

Such an equivalence between creativity and DT tests is also implied by the studies on the threshold theory of creativity (according to which creativity and intelligence are positively related only up to an IQ of 120). These studies analyze the relationship between intelligence and creativity, often using IQ tests to assess the former and DT tests to assess the latter (e.g. Kim, 2005; Preckel, Holling, & Wiese, 2006).

Arguably, part of the controversy regarding the threshold theory of creativity, with some researchers arguing for and others against it, stems from the fact that some researchers analyze the relationship between creative achievement and IQ (e.g. Park, Lubinski, & Benbow, 2007), while other researchers analyze the relationship between DT and IQ (Preckel et al., 2006).

It is evident that a comparison between IQ and such distinct constructs (DT and creative accomplishments) will never provide a single answer. Yet (to the best of my knowledge) nobody has ever noted this stark ambiguity in a published paper. In my opinion, this is an example of the kind of impasse that conceptual confusion can lead to.

In the history of creativity research, DT has not been the only construct taken to be synonymous with creativity. The CPS (Creative Personality Scale), a 30-item adjective check-list, was assumed to represent "trait creativity" and on this assumption a behavior genetic study has even claimed to find evidence for its emergenic nature (Waller, Bouchard, Lykken, Tellegen, & Blacker, 1993).

It is important to realize is that the terms "creative potential" or "creativity tests" are too general and poorly defined to be of any use to creativity researchers, at least as they are currently used. In fact, this misuse has caused a great deal of confusion, with the most unfortunate consequence that, according to psychology's historical development, various tests or scales have been equated with measures of "core" creative potential (e.g. Mednick's RAT (Mednick & Mednick, 1967); Torrance's TTCT (Torrance, 1974), or even Gough's Creative Personality Scale (Gough, 1979)). Moreover, it has limited the scope of the past research on creativity, as one single construct has been considered a satisfactory assessment of an individual's creative potential or even of creativity tout court.

If the label "creativity test" is applied to DT tests, then it should be applied also to IQ tests, personality scales and developmental variables that are predictive of a person's creativity.

Few researchers would argue that having a high score on RAT or DT tests alone is a sufficient condition to be creative (i.e. to create novel, appropriate products).

Having a high IQ or a strong motivation and persistence (Cox, 1926; Roe, 1953), are as much a part of one's creative potential as being excellent divergent thinkers. Moreover, factors can differentially affect creative performance (e.g. more analytical thinking and conscientiousness for scientific vs artistic creativity). However, a set of variables, such as Openness to Experience, IQ and DT are likely to be beneficial to creativity in every field.

In my opinion, the fact that these constructs are not closely related makes it unlikely that a general factor of creative potential (i.e. "trait creativity") will ever be found.

It must be noted that not all the researchers are trapped in this confusion. Feist's updated model of creativity for example considers creative thought and behavior as influenced but distinct from genetic–epigenetic influences, brain characteristics, cognitive traits, motivational-affective traits, clinical traits and social traits (Feist, 2010).

4. Measurement of creativity

As a measure of scientific creativity, citation counts are consistent with my definition of creativity (Simonton, 2002).

Another example of an appropriate measurement of creativity is provided by Park et al. (2007). In this study, earning a doctorate, earning tenure at a top-50 U.S. University, securing a patent or publishing a novel were all considered aspects of creativity. This study found that both overall ability level and ability tilt (difference between scores on mathematical and verbal ability tests) in 12-year olds are significant predictors of creative accomplishments 20 years later. This study employed the SAT as a measure of academic intelligence and found that differential exceptional verbal and mathematical intelligence were correlated with accomplishments in the humanities and in the "hard" sciences. This sample of 2409 gifted children, earned later in life 817 patents and published 93 books. One participant was even awarded the Fields Medal and another participant won the John Bates Clark Medal (most astounding economist under 40) (Park et al., 2007).

The requirement for entry in this sample was that the 12 years old student scored in the top 1% (compared to norms for 18 years old students). Thus, it can be argued that SAT is a satisfactory measure of creative potential. It is worth noting that, despite this, the authors did not regard the SAT a creativity test and few creativity researchers would probably do so. This is in contrast to the fact that creativity researchers constantly apply this term to DT tests or other pyschometric scales solely on the grounds that they predict creative achievement. I maintain that the term "creativity test" should be restricted to scales that measure a person's or a product's creativity.

Because the product is an essential component of creativity, the Consensual Assessment Technique (CAT) (Amabile, 1982) might be regarded as a measure of product's creativity. However, insofar as the CAT shows test–retest reliability, it also measures a trait. Creative production by the same individual evaluated using the CAT shows a moderate degree of test–retest reliability, around 0.5 (Baer, 2010), which is not very high compared to most psychometric instruments. Besides, creativity assessed using the CAT shows a high degree of domain specificity (i.e. very low correlations between creative performance in different domains). Thus, the CAT can assess one's creative potential in specific domains and not a general "trait creativity". Moreover, the CAT relies on a fixed number of creative tasks. Since the probability of coming up with a successful creative product is a function of quantity (Simonton, 2003), the CAT disregards this aspect, because it relies on assessment of only a limited number of products.

Besides the CAT relies only on experts' ratings of creativity whereas it could be argued that peer ratings are as important (for example, the success of a novel or a movie is likely to depend as much on the general public as on experts' judgments). Thus, the CAT cannot be considered a sound and thorough measure of creative potential and it is still an unsatisfactory laboratory-based measure of product's creativity.

Measures of creative achievement in the form of self report questionnaires can be considered a person's creativity test insofar as they measure the quantity and creativity of the products generated by people.

An advantage of self report measures of creative achievement (e.g. CAQ) is that they tap into personal forms of creativity that are "ignored" by more external, objective criteria such as the ones reviewed above. As Stein (1953) argued, "it is necessary to distinguish between internal and external frames of reference".

Thus, the "introspective" evaluation of creative accomplishments provides the researcher interested in the assessment of a person's creativity with valuable information that more objective measures based on impact and recognition would not tap into. In light of this, unstructured or semi-structured interviews could provide the researcher with precious information about everyday creative activities that could be missed by more standardized questionnaires. In fact, little-c or mini-c creativity tends to be more idiosyncratic and to have more personal meaning which impersonal questionnaires would fail to appreciate.

The researcher (with a sound knowledge of the creative process and a clear concept in mind of what creativity really is) could guide the creative individual through the process of identifying his/her creative accomplishments. For example, he/she could start asking general questions (e.g. "Have you recently had meaningful insights or experiences that led to personal growth or practical applications?") and then proceed to more specific questions related to the activities listed by the individual, thus trying to determine whether they conform to the more scientific view of creativity. The outcome of this interview process would provide both qualitative and quantitative information on the creative individual even at "lower" (e.g. mini-c) levels of creative accomplishment.

5. Does a general factor of creativity exist?

Since, as I highlighted in Section 1, my proposed definition of creativity corresponds to that of creative achievement, a general factor of creativity cannot exist (this is due to the simple reason that creative achievement is not a process measured by psychometric tests). However, in Section 1 I made the distinction between creativity (creative achievement) and creative potential. I then argued that creative potential can be subdivided into creative cognition and creative personality.

If certain cognitive or personality variables were found to be related to creativity (creative achievement), and these variables were in turn related to each other so that factor analysis revealed the existence of a general factor of creative personality or cognition, then one could claim to have found evidence for the existence of a general factor of creative personality or cognition.

Studies of the personality of creators in the arts and the sciences have revealed that they tend to share certain personality characteristics, such as openness to experience, introversion, autonomy, norm doubting, self confidence, ambition, dominance, hostility and impulsivity (Feist, 1998).

This nurtures hope that a general factor of creative personality could be discovered. However, large differences between the personality of scientists and artists were found, and this leaves open the possibility that this putative general factor of the creative personality could be partly domain specific. Granted this, the mistake of using the word creativity as synonymous with the general factor of creative personality should be avoided.

Regarding creative cognition, no studies so far support the existence of a general factor as in for intelligence. For example, in a recent review of neuroimaging studies of creativity (Arden et al., 2010), little overlap was found in brain activity patterns between different tests purported to measure creative cognition (DT, RAT, Open Problems, Insight Problems) (Arden et al., 2010). The task of finding a general factor of creative cognition is made even more problematic by the fact that all tests that participate in the generation of a creative product should be included in any study of the underlying neurological or psychometric structure of creative cognition. In regard to this, the study cited above made the mistake of not including, among other variables, convergent thinking processes among the creative cognition tasks. Instead, IQ tests were used only as a control variable. So even if a common neurological activity pattern underlying performance on the RAT, DT, Open Problems and Insight problems had been found by the authors, this could not have been considered evidence for a general factor of creative cognition, because an important component of creative cognition (IQ) was left out of the analysis. In the same way, any studies using a factor analytic approach to results of psychometric tests should include in the analysis all cognitive processes that take part in the generation of creative products. Another major problem is the likely possibility that

different cognitive skills are used in different types of creative activities. Factor-analytic studies that are not based on a solid theoretical foundation but that instead simply pull together scores from a wide range of tests chosen according to convention or the author's instincts are prone to produce sloppy conclusions. The Remote Associates test and the divergent thinking tests are based on two quite distinct theories of creativity, with the former emphasizing the associative and synthetic nature of creativity (Mednick, 1967), and the latter giving more importance to the generation of novel and original ideas (Guilford, 1967).

Another example of a mistake caused by this lack of theoretical rationale is provided by a study which claimed to have found a general creativity factor and two creativity sub-factors (Penke, 2003). This study employed 5 different indicators of creativity (T-88 elaboration, T-88 originality, self report, peer report and video report ratings of "creativity"). Personality (E, O, C) and intelligence (g, gc, gf) were included among the predictors. The author did not explain why he adopted self and peer reports of "creativity" (which in this study lumped together personality and cognitive traits perceived by oneself or their peers to be "creative") but not such variables as E, O and C as indicators of creativity. Also, the author did not explain why intelligence was not adopted as an indicator of creativity, but performance on a drawing test (T-88) was. In reality, the author simply followed convention. However, good science since Galileo cannot be based on following convention.

At a first look, a limitation of that study is the pretension to extract a general factor of creativity out of only 5 psychometric scales. As we have seen, the creative process consists of many more cognitive skills. However, in this the biggest drawback is that the choice of the psychometric scales was not based on a theoretical rationale.

The approach I present in this paper would prevent this mistake in all future studies of creativity, as any brain imaging or factor-analytic studies would have to select tasks of creative cognition with firm reference to a clear and simple definition, which is that of cognitive processes that concur in the generation of a creative product. By staying too attached to convention, one will make the error of being biased toward certain cognitive processes (e.g. DT) at the expense of others (e.g. memory).

On the other hand, the vast majority of creativity research is based on a correlational approach. It is evident that more experimental studies are needed to discover which cognitive processes are employed during the generation of creative products. Cognitive psychologists have mainly focused on the contribution of working memory and, more specifically, "mental synthesis", which can be defined as "the manipulation and transformation of visual images to produce new configurations or discover novel emergent properties" (Pearson, 2001). Many anecdotal reports suggest that such synthesis might provide the basis for important artistic and scientific discoveries, such as Einstein's own reports of the mental operations that led him to discover the general theory of relativity (Ghiselin, 1952) or Watson's insights into the double-helix structure of DNA (Watson, 1968). Various authors have argued that mental synthesis plays a role during the design phase in architecture and engineering (Purcell & Gero, 1998; Verstijnen, Van Leeuwen, Goldschmidt, Hamel, & Hennessey, 1998).

A task developed by Finke and Slayton (1988), commonly referred to as "creative synthesis task", has guided much of the research on mental synthesis (Pearson, 2001).

Performance on this task is determined by the number of legitimate patterns, and the creativity and originality of these productions as rated by independent judges (Helstrup & Anderson, 1991; Pearson, 2001).

It is unfortunate that the vast majority of correlational research has ignored this important aspect of creative cognition, which could be fruitfully compared to other cognitive strategies such as divergent thinking.

6. Conclusion

In this paper, I attempted a clarification of the notion of creativity and criticized the use of this concept in academic publications. A framework consisting of three dimensions (novelty, appropriateness/usefulness and impact) was provided within which creativity can be defined and measured.

I highlighted the lack of a clear separation between the definitions of creativity of products, people and creative potential in the literature and showed that this can lead to flawed studies and mistaken conclusions, and hamper the progress of creativity research.

The overall conclusion that creativity researchers must face is this: a person's creativity is a biographical phenomenon and as such, it cannot be assessed with psychometric instruments. Researchers eager to measure people's creativity must be aware that neither DT tests, nor IQ tests, nor the Consensual Assessment Technique can measure a person's creativity. At best, these instruments can assesss aspects of his/her creative potential. But even then, no single measure can tap into "trait creativity". Future attempts to find a general neurological or psychometric factor of creativity must proceed from a clearer framework such as the one put forward in this paper.

The assessment of creativity would benefit from the employment of varied methods, as this would produce a more comprehensive assessment.

Since creativity is the sum of creative accomplishments, measures based on both external, objective (research degrees, Nobel prize or Field medal, impact factor of publications) and subjective (self report questionnaires of creative accomplishments, interviews) criteria must be used in order to tap into the different aspects of creativity, which roughly correspond to the four C's of creativity.

Finally, I argued that unstructured or semi-structured interviews would allow the researcher to collect precious information about people's creativity that would not be revealed by more impersonal methods, such as those based on external recognition or standardized questionnaires.

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